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DOCKET NO. 94-C-096C4 (STMI01-94096) **PATENT**
Customer No. 30425

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:	:	KUEI-WU HUANG ET AL
Serial No.	:	09/517,987
Filed	:	March 3, 2000
For	:	METHOD OF FORMING PLANARIZED STRUCTURES IN AN INTEGRATED CIRCUIT
Group No.	:	2812
Examiner	:	R. Booth

MAIL STOP APPEAL BRIEF - PATENTS
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

APPELLANTS' REPLY BRIEF

This Reply Brief is submitted in the application identified above in response to the Examiner's Answer mailed September 9, 2004.

The Examiner's Answer states:

> Appellant argues that the Hsu reference fails to disclose that the doped epitaxial layer regions 50 function together with the regions (24, 26) as source/drain regions. The examiner respectfully disagrees since the structure of the doped regions (50, 24, 26) in Hsu is the same structure shown in appellant's specification in fig. 5A, for example, as region 40 of appellant's specification is also a doped epitaxial layer. Clearly, since the epitaxial region 50 of Hsu and source/drain regions (24,26) are in electrical contact with each other, they must necessarily function together as source/drain regions as required by the independent claims of the instant appeal.

Examiner's Answer, pages 5–6. However, in the claimed invention, the lightly doped source/drain regions within the substrate function as LDD extensions of the (normally doped) source and drain regions within the epitaxial layer above the substrate, where electron/hole pair generation or recombination occur to provide charge transport and therefore current. *Hsu*, on the other hand, very heavily ("highly") dopes the epitaxial layer, making clear that the layer merely serves as an electrical connection from the silicide layer 54 formed thereon down to the normally-doped source and drain regions 24, 26 within the substrate:

> A pair of epitaxial layers 50 of single crystalline silicon is selectively grown from the surface 14 of bare silicon directly over the source and drain regions 24 and 26 in the usual manner, see FIG. 4. The layers 50 should be grown to a thickness no greater than the thickness of the gate electrode 20 so that the layers 50 do not extend over the gate 20 and short the source and drain regions 24 and 26 together. The layer 50 is then subjected to a relatively high energy arsenic implantation indicated as 52 in FIG. 4, to highly dope the layer 50 down to a depth approximately equal to its thickness or slightly less. During the formation of the epitaxial layer 50, some of the impurities of the source and drain regions 24 and 26 will diffuse upwardly into the epitaxial layer 50 a short distance. Therefore, the ion implant need only reach a depth well into this upwardly diffused region. Care should be taken so that the ion implantation does not extend to a depth greater than the depth of the source and drain regions 24 and 26. A layer 54 of refractory metal silicide is then formed on the

> highly doped epitaxial layer by depositing a layer of refractory metal, such as titanium or tungsten, and then heating the device 10 sufficiently until the refractory metal combines with the silicon at the surface 14 and thereby forming metal silicide. ***This layer 54 forms the desired low resistance contact to the very shallow source and drain regions 24 and 26.***

Hsu, column 2, line 52 through column 3, line 10 (emphasis added). The structure disclosed in *Hsu*, while superficially similar, is not identical to the claimed structure described in Applicants' specification. The fact that the highly doped epitaxial regions 50 are in electrical contact with the source and drain regions 24, 26 does not "necessarily" mean that the two pairs of regions function together as source/drain regions, any more than electrical contact of the silicide layer 54 renders those regions part of a "source" or "drain" region. The highly doped epitaxial regions 50 are merely conductive connections, in the nature of conductive plugs.

The Examiner's Answer also states:

> Concerning the argument that claims 87 and 90 are not shown by the Hsu reference, the term "LDD" includes the relative phrase "lightly doped" and since the claims are to be given their broadest reasonable interpretation and there is no standard to define the phrase "lightly doped", the Hsu reference reads on these claims. Furthermore, the particular dose used in Hsu to form the source/drain regions 24, 26 (see col. 2-lines 26-29) is of a level which will form doping regions of lower concentration compared to conventional source/drain regions.

Examiner's Answer, page 6. The assertion that no standard exists for "lightly doped" source and drain regions is unsupported by the record and contrary to the specification, which identifies

implantation dosage and energy.[1] Specification, page 14, lines 1–4. Moreover, the assertion is belied by the subsequently contention that the concentration of Hsu "lower" than conventional source/drain regions, a tacit acknowledgement that conventional source/drain doping levels have a lower limit.

None of the cited references, taken alone or in combination, show or suggest all features of the invention claimed in Groups A–C. Therefore, the rejections under 35 U.S.C. §§ 102 and 103 are improper. Applicant respectfully requests that the Board of Appeals reverse the decision of the Examiner below rejecting pending claims 77–96 in this application.

Respectfully submitted,

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Date: 11-9-04

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[1] Applicant's note that *Hsu* teaches use of a very low energy (10 KeV) implantation forming shallow–but not necessarily lightly doped–source and drain regions 24, 26.

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Sir:

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